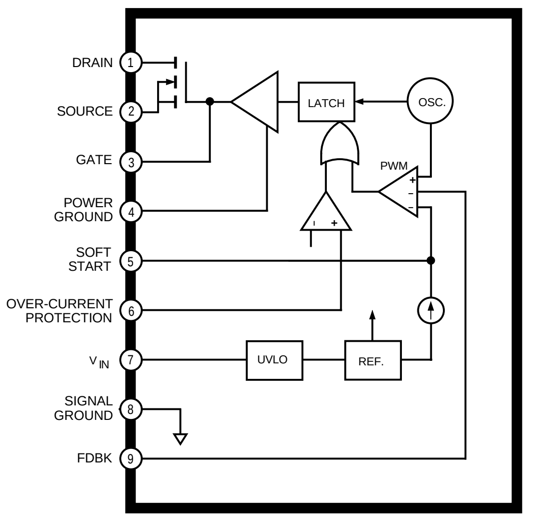
STR-S6401 AND STR-S6401F

OFF-LINE SWITCHING REGULATORS – WITH POWER MOSFET OUTPUT



Dwg. PK-003

These devices are specifically designed to meet the requirements for increased integration and reliability in off-line flyback (STR-S6401) and forward (STR-S6401F) converters operating in a fixed-frequency PWM mode. Each device incorporates the primary control and drive circuits with an avalanche-rated power MOSFET. Crucial system parameters such as switching frequency and maximum duty cycle are fixed during manufacture. The STR-S6401 and STR-S6401F differ only in their maximum duty cycle. Control circuit decoupling and layout are optimized within each device.

Cycle-by-cycle and average-current limiting, soft start, under-voltage lockout with hysteresis, and thermal shutdown protect the device during all normal and overload conditions. The performance and reliability of these devices, and their variable-frequency counterparts, has been proven in substantial volume production.

The requirements of high dielectric isolation and low transient thermal impedance and steady-state thermal resistance are satisfied in an over-molded, 9-pin single in-line power package. Similar off-line switching regulators, with output ratings to 800 V at 5 A, are also available.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{IN} .... **35 V**
Drain-Source Voltage, V_{DS} .... **500 V**
Drain Current, I_D
  continuous .... **±10 A**
  single pulse, $t_w \le 1$ ms .... **±40 A**
Avalanche Energy, E_A
  single pulse .... **500 mJ**
Gate-Source Voltage, V_{GS} .... **±20 V**
Gate-Drive Current Range,
  I_G .... **-0.7 A to +1.5 A**
Over-Current Protection Voltage Range,
  V_{OCP} .... **-0.3 V to +4.0 V**
Insulation RMS Voltage,
  $V_{WM(RMS)}$ .... **2000 V**
Package Power Dissipation,
  P_D .... **See Graph**
FET Channel Temperature, T_J ...... **+150°C**
Internal Frame Temperature, T_F ... **+125°C**
Operating Temperature Range,
  T_A .... **-20°C to +125°C**
Storage Temperature Range,
  T_{stg} .... **-30°C to +125°C**

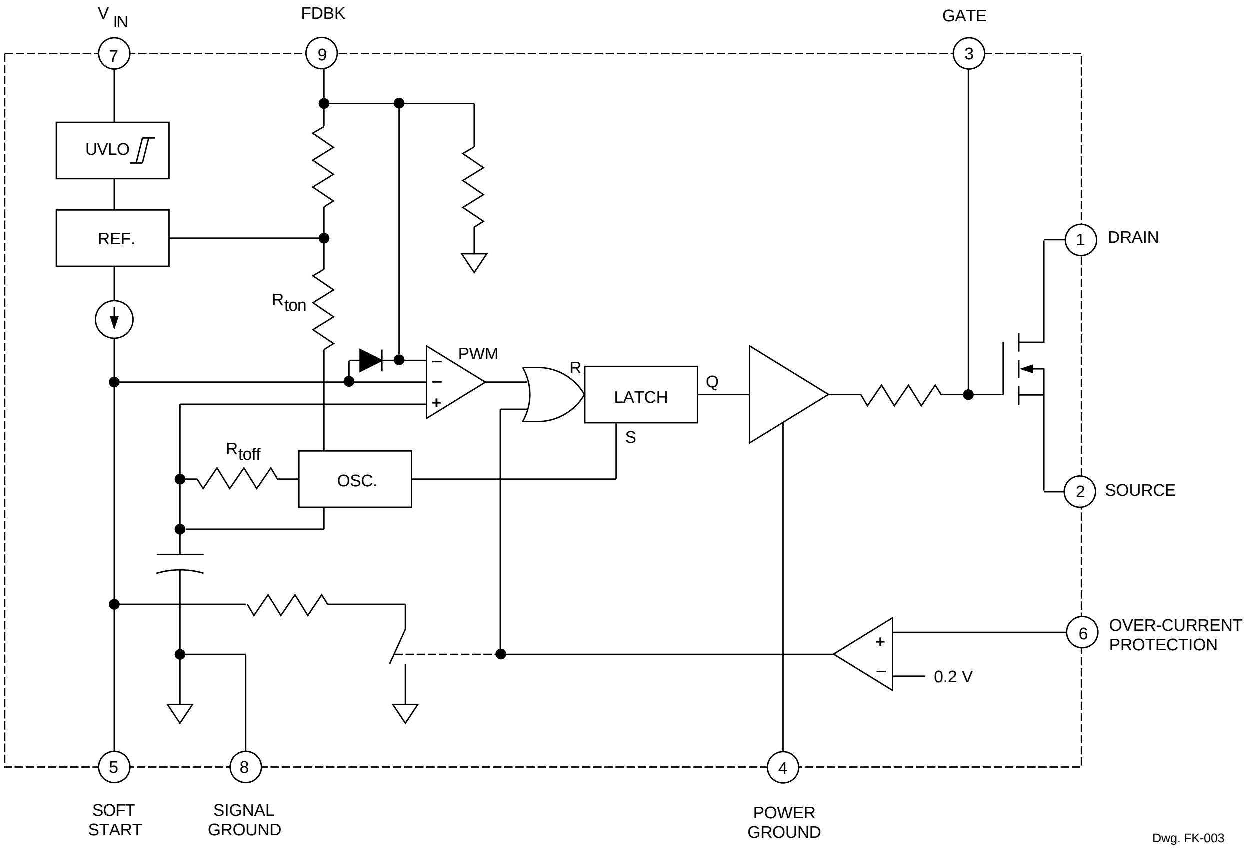
FEATURES

- PWM Flyback Conversion or Forward Conversion
- Output Power to 250 W
- Pulse-by-Pulse Current Limiting
- Fixed-Frequency 100 kHz PWM
- Avalanche-Rated Power MOSFET Switch
- Soft Start
- Internal Under-Voltage Lockout and Thermal Shutdown
- Low External Component Count
- Over-Molded SIP with Isolated Heat Spreader

Always order by complete part number:

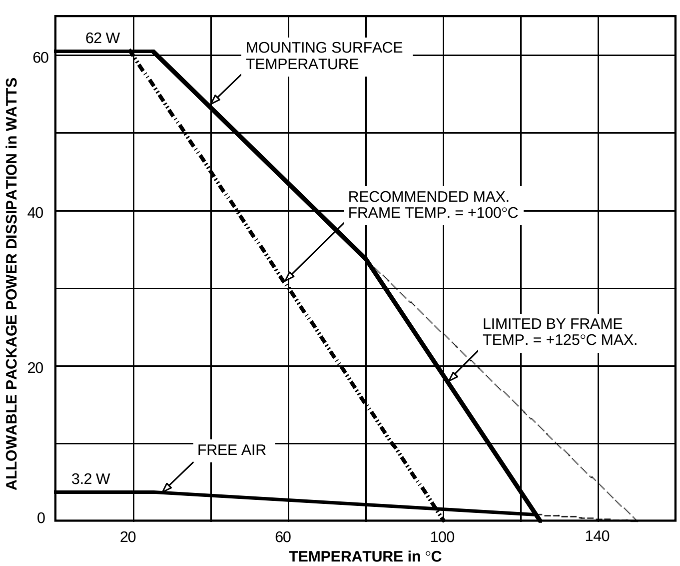
STR-S6401 or **STR-S6401F** .

FUNCTIONAL BLOCK DIAGRAM



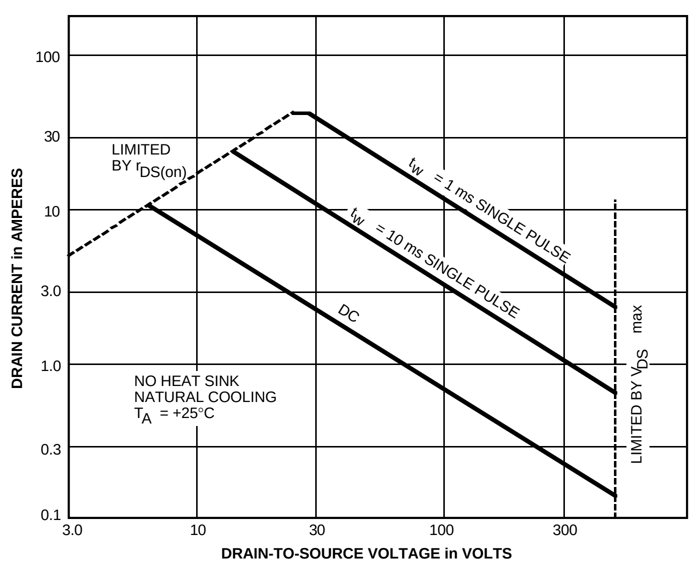
Dwg. FK-003

ALLOWABLE PACKAGE POWER DISSIPATION



Dwg. GK-003

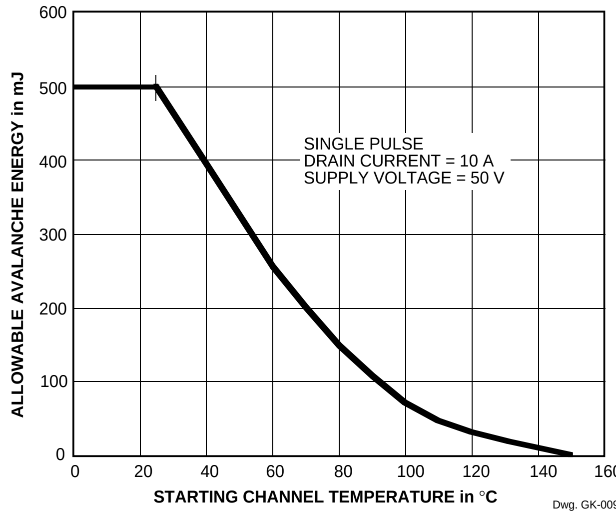
MAXIMUM SAFE OPERATING AREA



Dwg. GK-004

Allegro MicroSystems, Inc.
115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

ALLOWABLE AVALANCHE ENERGY

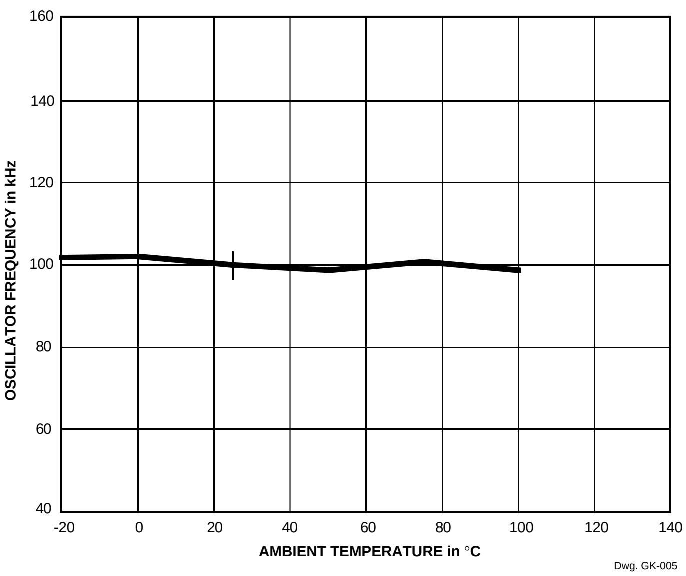


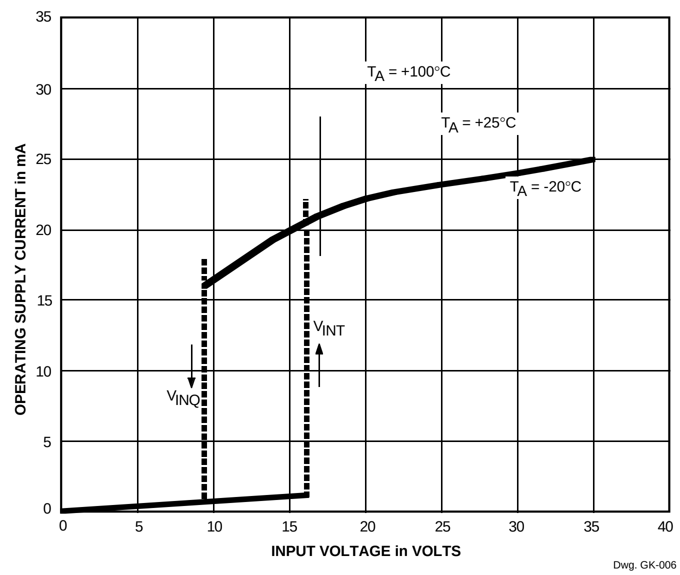
ELECTRICAL CHARACTERISTICS at T_A = +25°C, V_{IN} = 17 V, voltage measurements are referenced to Signal Ground (pin 8) (unless otherwise noted).

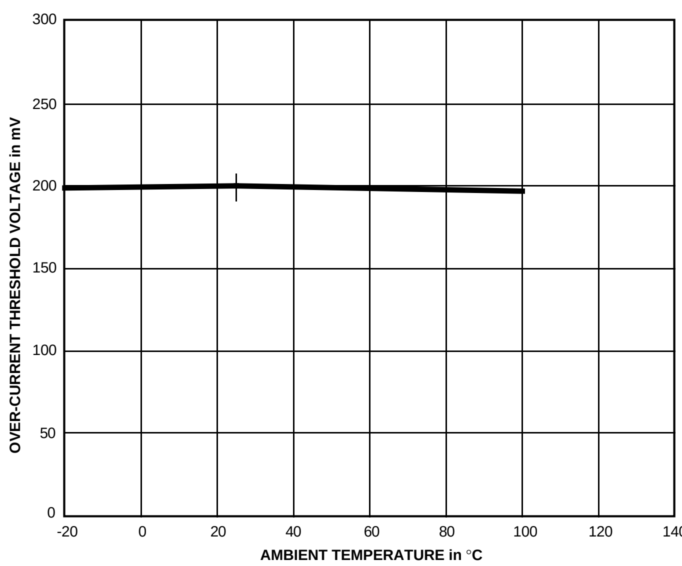
Characteristic	Symbol	Test Conditions	Limits Min.	Limits Typ.	Limits Max.	Units
On-State Voltage	V_{INT}	Turn-on, increasing V_{IN}	14.4	16	17.6	V
Under-Voltage Lockout	V_{INQ}	Turn-off, decreasing V_{IN}	8.4	9.4	10.4	V
FET Leakage Current	I_{DSS}	V_{DS} = 400 V	–	–	300	µA
FET ON Resistance	$r_{DS(on)}$	V_{GS} = 10 V, I_D = 5 A	–	0.5	0.6	Ω
Forward Transconductance	g_{fs}	V_{GS} = 10 V, I_D = 5 A	–	9.2	–	S
FET Input Capacitance	C_{iss}	V_{DS}=10 V, V_{GS}=0 V, f=1 MHz	–	1800	–	pF
Propagation Delay Time	t_{phl}	Turn-on, 10% V_{GS} to 10% V_{DS}	–	60	–	ns
	t_{plh}	Turn-off, 90% V_{GS} to 90% V_{DS}	–	140	–	ns
Oscillator Frequency	f_{osc}		93	100	107	kHz
Maximum ON Time	t_{on}	STR-S6401	5.1	5.7	6.5	µs
		STR-S6401F	3.8	4.5	5.2	µs
Over-Current Threshold	$V_{OCP(th)}$		160	200	240	mV
OCP Current	I_{OCP}		-250	-400	-550	µA
Feedback Current	I_{FDBK}		–	-1.8	–	mA
Soft Start Threshold Voltage	$V_{SS(th)}$		–	–	0.4	V
Soft Start Current	I_{SS}	V_{SS} = 0 V	–	-100	–	µA
Power Ground Current	I_{PG}	t_w = 200 ns	–	-1.0	-1.5	A
Supply Current	$I_{IN(ON)}$	Operating	–	23	–	mA
	$I_{IN(OFF)}$	Start up, V_{IN} = 12 V	–	–	500	µA
Insulation RMS Voltage	$V_{WM(RMS)}$	All terminals simultaneous reference metal plate against backside	2000	–	–	V
Thermal Resistance	$R_{\theta JM}$	FET channel to mounting surface	–	2.0	–	°C/W

NOTES: Negative current is defined as coming out of (sourcing) the specified device terminal.
Typical Data is for design information only.

TYPICAL CHARACTERISTICS



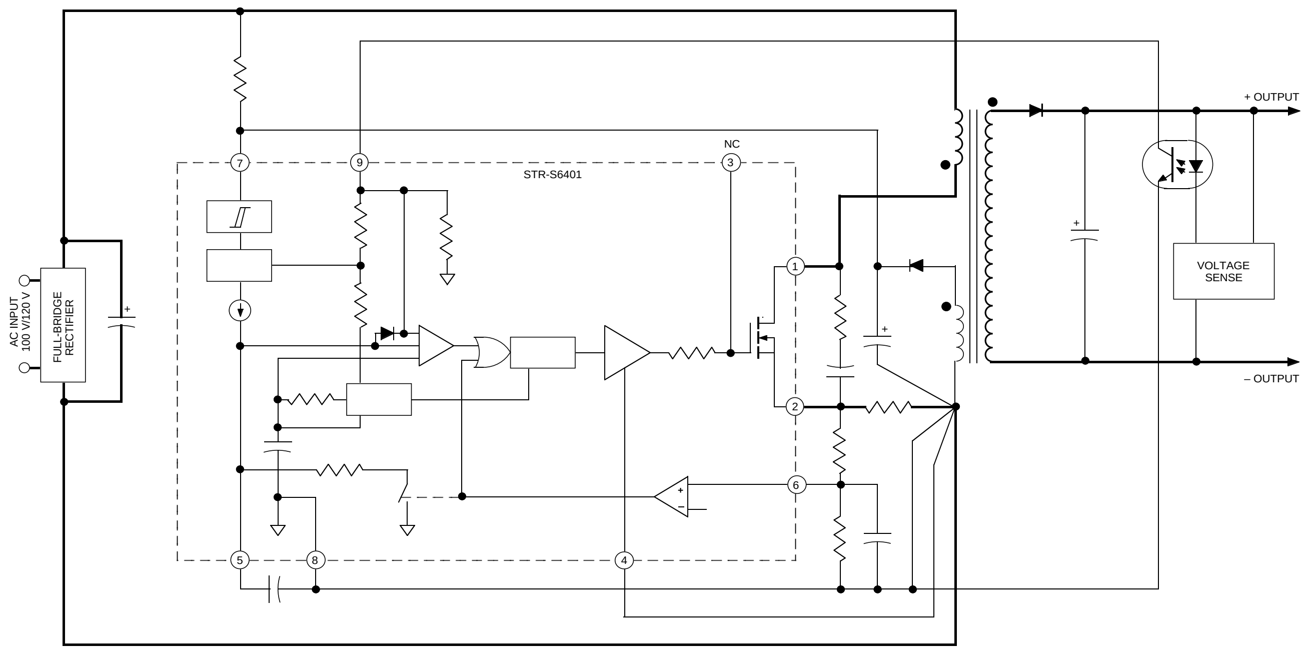




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TYPICAL PWM FLYBACK CONVERSION USING STR-S6401

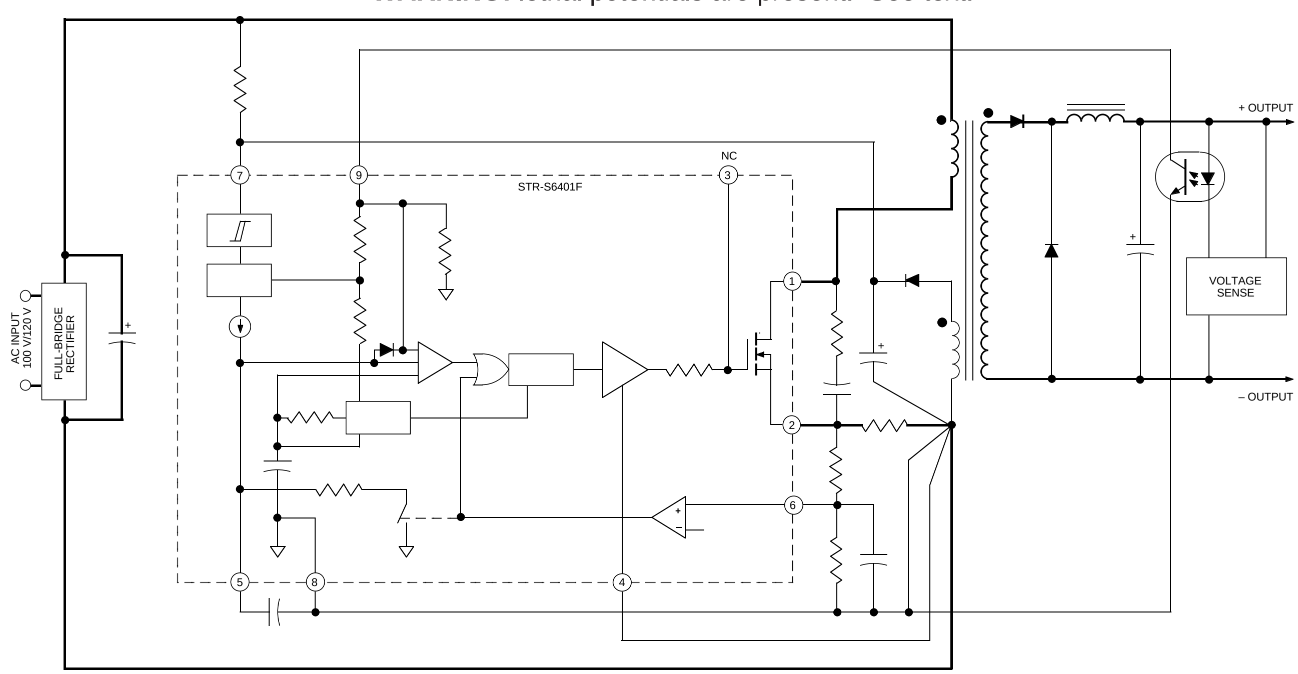
WARNING: lethal potentials are present. See text.



Dwg. EK-003

TYPICAL PWM FORWARD CONVERSION USING STR-S6401F

WARNING: lethal potentials are present. See text.



Dwg. EK-003-1

APPLICATIONS INFORMATION

WARNING — These devices are designed to be operated at lethal voltages and energy levels.
Circuit designs that embody these components must conform with applicable safety requirements.
Precautions must be taken to prevent accidental contact with power-line potentials.
Do not connect grounded test equipment.

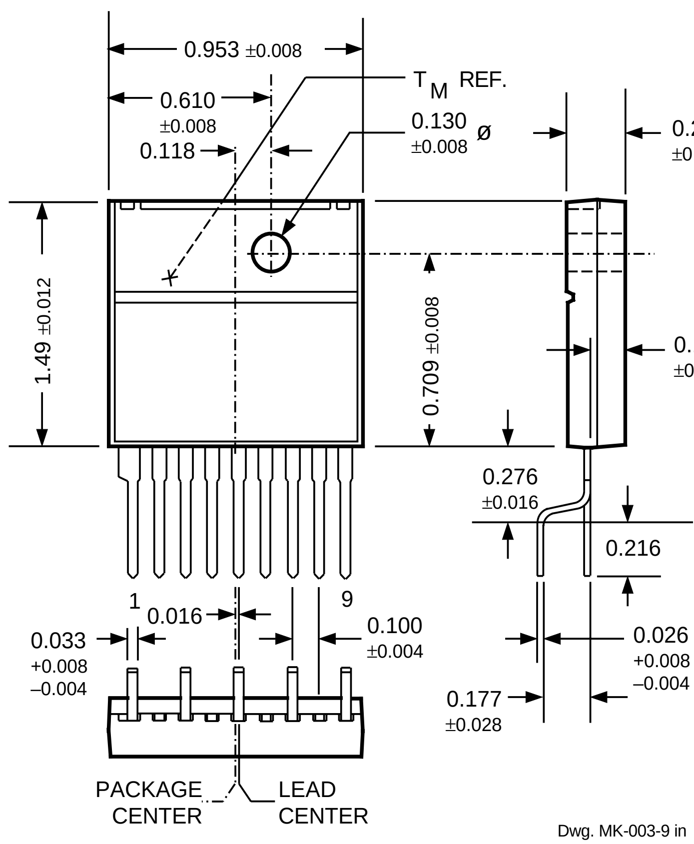
The use of an isolation transformer is recommended during circuit development and breadboarding.

The power MOSFET outputs of these devices are similar to the International Rectifier type IRFP448. These devices feature an excellent combination of fast switching, ruggedized device design, low on-resistance, and cost effectiveness.

Recommended mounting hardware torque:
4.34 - 5.79 lbf•ft (6 – 8 kg•cm or 0.588 – 0.784 Nm).

Recommended metal-oxide-filled, alkyl-degenerated oil base, silicone grease:
Dow Corning 340, or equivalent

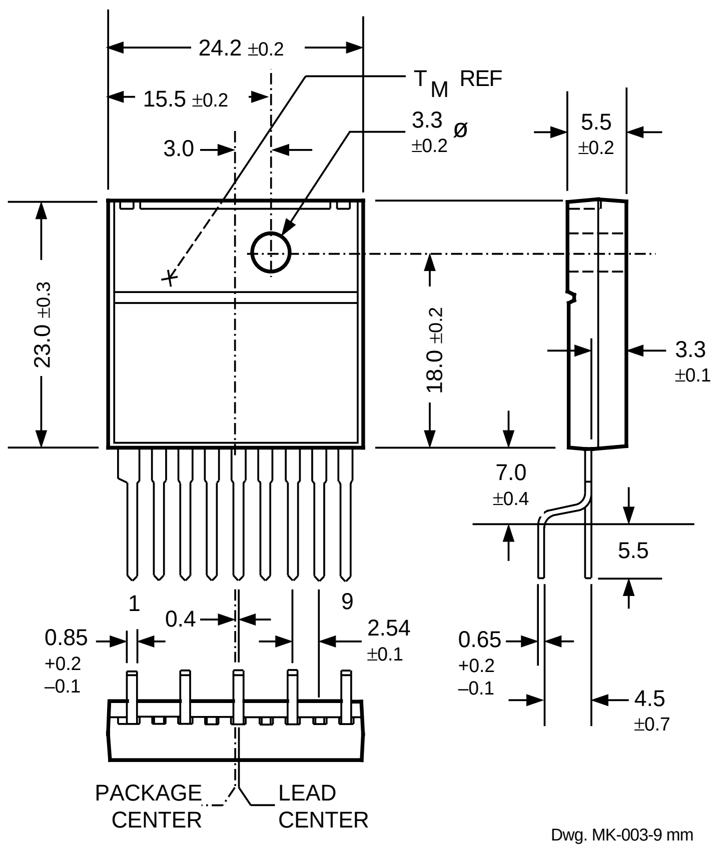
Dimensions in Inches
(Based on 1 mm = 0.03937")



NOTE: Exact body and lead configuration at vendor's option within limits shown.

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Dimensions in Millimeters



NOTE: Exact body and lead configuration at vendor’s option within limits shown.

POWER CONVERSION/POWER MANAGEMENT SELECTION GUIDES

SWITCHING REGULATOR PMCMs

Part Number*	Application	AC In	Max P_O	Power Switch		
5703	Quasi-Resonant Flyback Converter	110/120 V	140 W	500 V	6 A	Bipolar
5707	Quasi-Resonant Flyback Convertter	85-265 V 220/240V	90 W 140 W	850 V	6 A	Bipolar
5708	Quasi-Resonant Flyback Converter	85-265 V 220/240 V	120 W 180 W	850 V	7.5 A	Bipolar
6511	Quasi-Resonant Flyback Converter	110/120 V	180 W	450 V	11 A	MOSFET
6703	Quasi-Resonant Flyback Converter	110/120V	140 W	500 V	6 A	Bipolar
6704	Quasi-Resonant Flyback Converter	110/120 V	100 W	500 V	5 A	Bipolar
6707	Quasi-Resonant Flyback converter	85-265 V 220/240 V	90 W 140 W	850 V	6 A	Bipolar
6708	Quasi-Resonant Flyback Converter	85-265 V 220/240 V	120 W 180 W	850 V	7.5 A	Bipolar
6709	Quasi-Resonant Flyback Converter	85-265 V 220/240 V	160 W 220 W	850 W	10 A	Bipolar

* Complete part number includes additional characters to indicate operating temperature range and package style.

LINEAR REGULATOR ICs

Part Number*	V_O	Max DC In	Max Dropout	Max I_O	Package
8184	3.0 V	10 V	300 mV @ 125 mA	250 mA	SOT-89
8187	3.3 V	10 V	300 mV @ 125 mA	250 mA	SOT-89
8188	2.5–3.3 V	10 V	300 mV @ 125 mA	250 mA	SOT-89
8188	2.5–3.3 V	10 V	300 mV @ 125 mA	250 mA	SOIC

* Complete part number includes additional characters to indicate operating temperature range and package style.

Also — 83145 and 84145 Latched, Universal Input-Voltage Switches.